Calumet Drainage Ditch Reverses Flow of River

Flood Lands Drained by Ten-Mile Ditch—Overflow Dams and Dry-Weather Bypass—Deep Cut Through Sand Dunes

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TO RECLAIM a tract of about 23½ square miles of good agricultural land in northern Indiana, which at present is practically worthless by reason of long continued flooding every year by the Little Calumet River, a ten-mile ditch is being excavated to reverse the flow of the river so that it will discharge directly into Lake Michigan instead of by a circuitous route to the Calumet River and then northward into the lake at South Chicago, Ill. The general situation is explained by Fig. 1. A considerable portion of the land may be used for truck gardening, as it is near to the cities of Chicago, Gary and Hammond; 2,000 acres are within the city limits of Gary, where 300 acres have been purchased for a public park. The entire area is within a district that is expected to become a great manufacturing center.

The Little Calumet River flows across the northwestern corner of Indiana, in Porter and Lake counties, its course being practically parallel with the shore of Lake Michigan, with its bed about 8 to 13 ft. above lake level, the basin of the river being defined by a line of high sand hills extending along the lake shore. This stream, with a maximum flood flow of 2,256 sec.-ft., overflows every winter and spring, forming a lake about 1x18 miles which remains for several months. The basin of the Little Calumet River, from the point where Salt Creek enters it to the state line, varies in width from ½ mile to nearly two miles. With years of deposits from the Little Calumet River, Salt Creek and Deep River, all arising in clay and soil districts, and with deposits also from decayed marsh grasses, there is now in this valley a rich soil varying in depth from one foot along the edge to 13 or 15 ft. near the river.

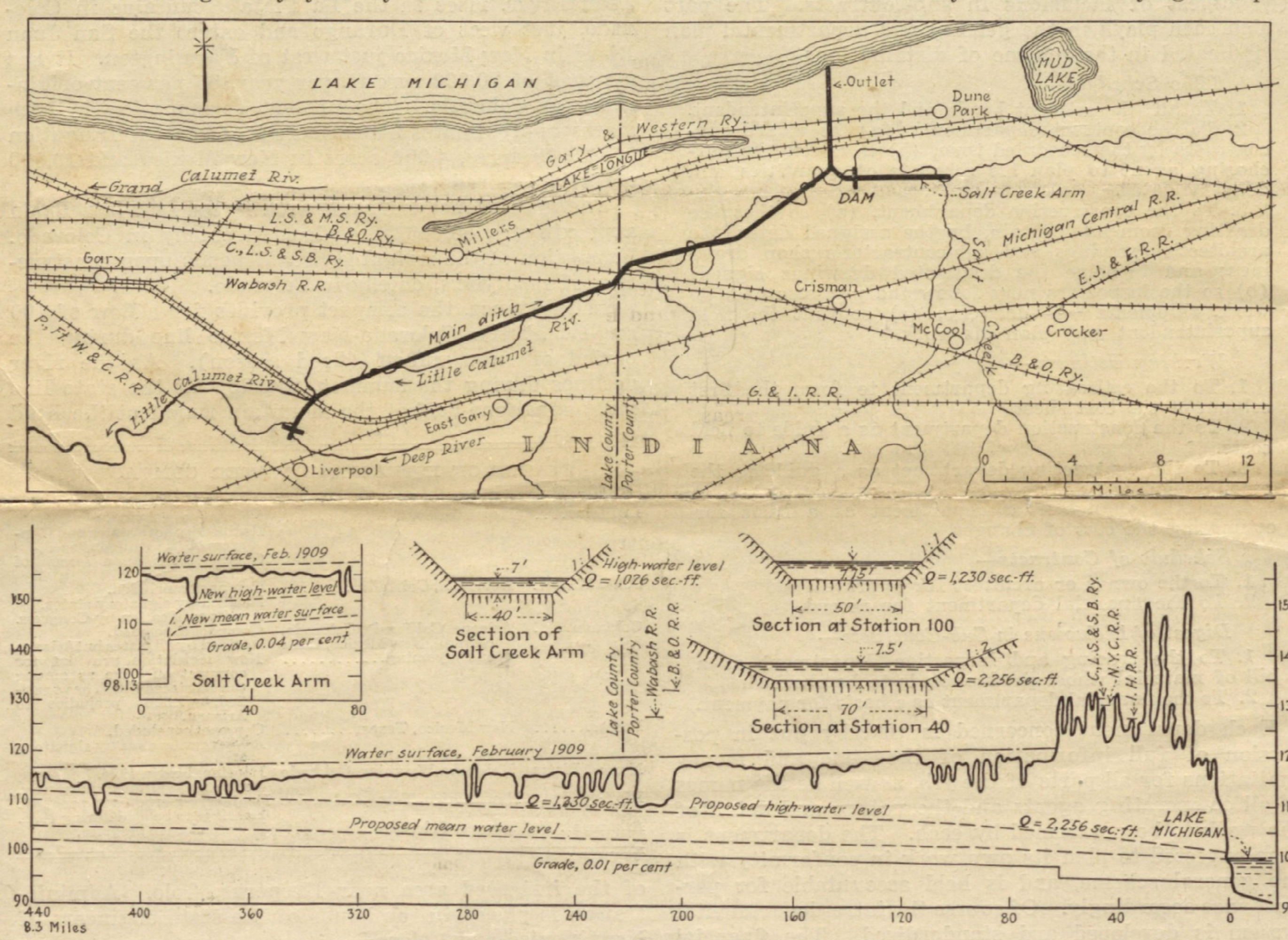

FIG. 1—CALUMET DRAINAGE DITCH IN INDIANA

To relieve the basin of these floods, it is intended to reverse the flow of the Little Calumet River and cut through the large sand dunes to Lake Michigan, about a mile west of the junction of Salt Creek with the Little Calumet. This is the nearest point to the lake, the distance being a little more than a mile. The main ditch starts at Deep River, a short distance from its present junction with the Little Calumet and runs almost in a straight line to the point where it joins the cut across to the lake. The Salt Creek arm starts at the junction of the Little Calumet and Salt Creek and runs direct to where the main ditch cuts through to the lake. These two ditches will take care of practically

reduced to a minimum. The builder of important structures must have his own transportation, machinery and equipment. He must go back to the source for his materials, i.e., to the manufacturer. Finally he must be organized to do as much of the work with his own force as possible. Our organization executes about 60 per cent of the work, subletting the other 40 per cent.

The time schedule, then, is the controlling factor in planning the work. It originates in the estimating department as do the other three documents necessary to enable other departments to plan their operations. The four control schedules are: (a) Time schedule; (b) working estimate; (c) schedule of contracts; and (d) digest of inclusions in sub-contracts. The part which each plays in the general and departmental plan is indicated in the scheme of distribution:

Time Schedule—

1. To all department heads and the superintendent.
2. To the contract department. (a) To award subcontracts by the scheduled time, (b) to enable the purchasing agent to plan his schedule of quantities and delivery dates.
3. To the construction department, (a) so that the drafting room may obtain, by the assigned dates, the architect's drawings and sub-contractor's shop drawings; and to have the designated drawings signed; (b) so the inspectors may follow the progress of shop work, shipments and delivery; (c) so that the field superintendent may plan his work.

Working Estimate—

1. To the estimating department to form the first column of the cost sheet.
2. To the construction department as a guide to field costs.
3. To the contracting department as a guide to the amounts allowed for purchases and sub-contracts.
4. To the change-order department as a basis for estimating the cost of changes.

Schedule of Contracts—

1. To the owner or architect for approval.
2. To the financial department for record.

Digest of Inclusions in Sub-Contracts—

1. To the tracing and inspection department as a bill of material whose production is to be checked.
2. To the financial department as a basis for payment.

Each department concerned is thereby put in possession of full information of the time and money limitations for all parts of the job, as well as the names of all co-operating agents and the nature and detail of the work to be performed by each. The department is then expected to plan its own work in conformity with the general scheme, and is held accountable for performance accordingly. Of course the intra-departmental system is developed and standardized. The financial section, for instance, has a highly refined system of cost accounting. And the construction section has an elaborately worked-out system of planning the distribution and handling of materials, the employment and control of labor, the sequence of operations, the use of mechanical plant and all that makes for construction efficiency. But these are studies in themselves, the present aim being only to explain the administrative organization of a large building company, and the method of planning its major operations.

Alaska R.R. Revenue and Expenses

Expenses for the operation and maintenance of the Alaska R.R. during the next fiscal year will be $2,605,000, it is estimated. The revenues will be $1,000,000. The deficit for the current fiscal year will be $1,500,000.

New Mexico-Colorado Water Compact Ratified by Congress

THE WATER compact between the states of New Mexico and Colorado concerning the waters of the La Plata River, ratified by Congress during January and signed by President Coolidge on Jan. 29, as noted in *Engineering News-Record*, p. 319, Feb. 19, is the first water treaty involving western rivers, to receive Congressional ratification. The compact now becomes operative and waters of the La Plata River will be distributed during the irrigation season of 1925.

The La Plata River, a small tributary of the San Juan River, rises in the La Plata Mountains in Colorado, just west of Durango and enters the San Juan River in New Mexico just west of Farmington. It has a runoff of 70,000 acre-ft. per year, 85 per cent originating in Colorado. The present consumption in both states approximates 30,000 acre-ft. from the irrigation of 23,000 acres, 4,000 acres in New Mexico and 19,000 acres in Colorado.

The undeveloped irrigable area in the La Plata Basin approximates 50,000 acres located chiefly in Colorado. Expansion of the irrigated area depends upon construction of reservoirs, chiefly in Colorado.

In substance, the compact provides for a flow of 100 sec.-ft. at the Colorado-New Mexico line during the period of snow runoff (flood season). As the river declines during the summer, the flow at the state line must equal one-half of the mountain runoff at the head of the irrigated area near Hesperus, Colo. Administration is placed in the hands of the state engineers of New Mexico and Colorado.

STATUS OF INTERSTATE WATER COMPACTS

River	*States Affected*	*Status*
La Plata.....	New Mexico, Colorado......	Compact concluded. Ratified by both states and Congress of the United States. Operative irrigation season of 1925.
South Platte..	Nebraska, Colorado.........	Compact concluded. Ratified by signatory states. Awaits ratification by Congress.
Colorado.....	Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming............	Compact concluded. Ratified by all states but Arizona. New legislation provides for compact effective as among the six states which have ratified, without prejudice to Arizona.
Pecos........	New Mexico, Texas.........	Compact concluded. Awaits ratification by signatory states.
North Platte	Nebraska, Wyoming, Colorado	Hearings held in 1924. Active negotiations under way.
Rio Grande..	New Mexico, Texas, Colorado	Engineering studies in progress. Hearings to be held during 1925.
Arkansas.....	Kansas, Colorado............	Negotiations in progress.

Broadly speaking, the compact protects the present development in both states, expansion in both is permitted, all controversy is settled and water titles for future development are determined. The compact may be modified or terminated at any time by mutual consent of the signatory states and upon such termination all rights then established shall continue unimpaired.

The La Plata River Water Compact was framed by Stephen B. Davis, Jr., of Las Vegas, N. M., with Charles A. May, state engineer, acting as consultant, representing New Mexico, and by Delph E. Carpenter of Greeley, Colo., with Ralph I. Meeker of Denver as engineering consultant, representing Colorado.

The accompanying table summarizes briefly the status of Western interstate water compacts which are chiefly concerned with the use of water for irrigation.

At the outlet the bottom of the ditch will be 4 ft. below water level.

Five new railroad bridges will be required and the abutments and piers of two others must be rebuilt because of the increased depth of the new channel. There will also be six new highway bridges. The New York Central Lines have started work on their two bridges and contracts for two highway bridges have been let. These bridges will be plate-girder deck structures with channel spans of 86 ft.

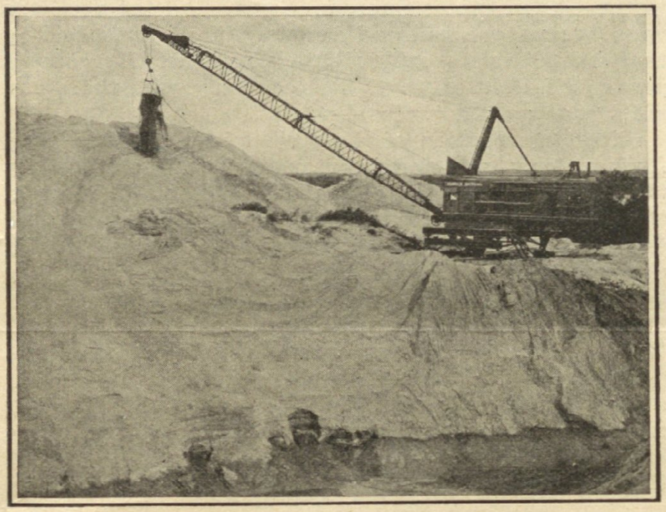

FIG. 4—DRAGLINE EXCAVATOR IN DEEP SAND CUT

Since the drainage area consists mainly of open country there is little pollution of the Little Calumet River above the point of its diversion to the lake, but should pollution increase owing to industrial development of the district steps would have to be taken to protect the water supply of Gary and adjacent towns which draw their supply from Lake Michigan. Indirectly this project will benefit the Chicago drainage canal and its Calumet-Sag branch by reducing the floods in the Calumet River, which is the stream formed by the junction of the Little Calumet and Grand Calumet. Flood flows in this stream at South Chicago now exceed 10,000 sec.-ft. at times, while the Calumet-Sag channel has a capacity of only 2,000 sec.-ft.

This ditch is being built under the direction of Judge H. H. Loring of the Porter County Circuit Court, for which A. P. Melton, Gary, Ind., is construction commissioner and chief engineer, with the writer as engineer in charge. The general contract was let to the Walb Construction Co., LaGrange, Ind., which company is doing the marsh excavation but has sublet the outlet channel through the sand hills to Broderick Brothers, Detroit, Mich. The contract price is $286,000, but additional court costs and attorney's fees will bring the total cost to about $335,000. Bonds have been issued for $225,000 and $100,000 has been paid in cash. It is expected to have the work completed by December, 1925.

Price of Contractors' Manual Is $5

In "Engineering Literature," in the Feb. 19 issue of *Engineering News-Record*, p. 327, appeared a review of the Manual of the Associated General Contractors of America. 1924 issue. The price of the book was stated as $0.50; it should have been $5.

Features of Design in 1,000-Foot Outdoor Swimming Pool

Independent Retaining Walls, Floor in Sections, and Complete Underdrain System Are Features of San Francisco's New Pool

BECAUSE of the large size of the new outdoor swimming pool recently built by the city of San Francisco, and because the site selected for it seems to be the natural sump or underground collecting point for drainage waters in this part of the peninsula, the design of walls, floor, drainage system and other features were worked out expressly to meet the requirements of this particular location. In other matters, however, such as expansion joints, a strictly waterproof finish, simplicity and convenience of operation, etc., the problems and their solution were such as might attend the design and construction of any outdoor swimming pool. The location is in a 60-acre municipal playground now being developed close to the ocean beach about 3 miles south of the Cliff House. The pool itself is 1,000 ft. long and 100 ft. wide except in the center section opposite the bath house where the width is 150 ft.

At the site selected for the pool the water table is about 4 ft. below the surface of the ground, which

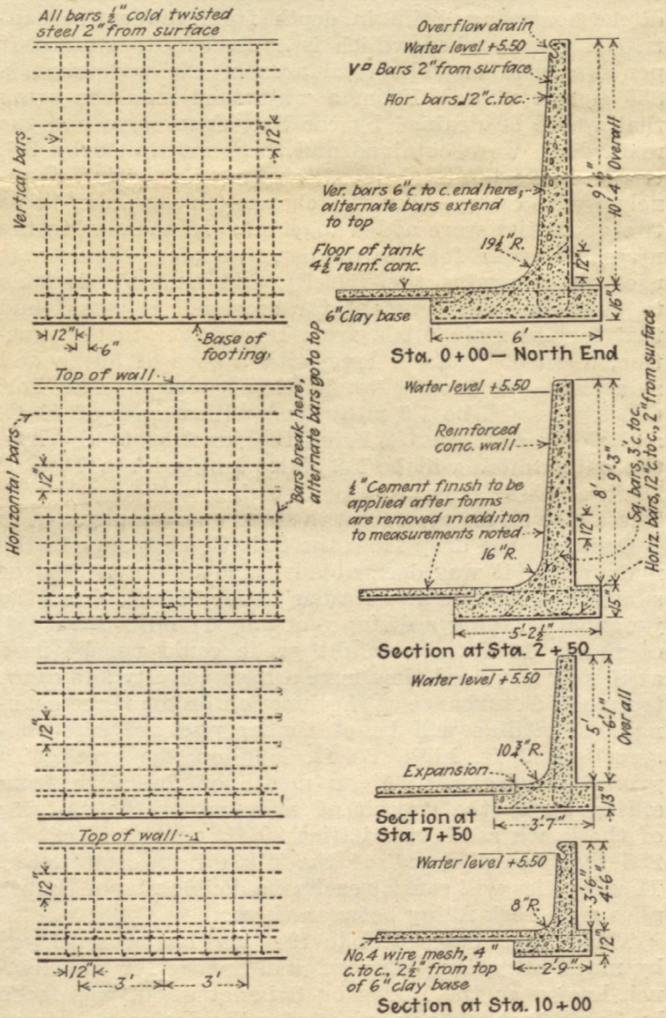

FIG. 1—CROSS-SECTIONS OF TANK WALL
Longitudinal and transverse views at both ends and at two intermediate points.

all of the flood water. With the water surface of Lake Michigan at El. 100, the elevations of bottom of drainage ditch are 110 at the connection with Salt Creek, 102 at Deep River, 98 at the junction with the outlet ditch and 95.5 at the lake.

Calculations as to the size of channel required to

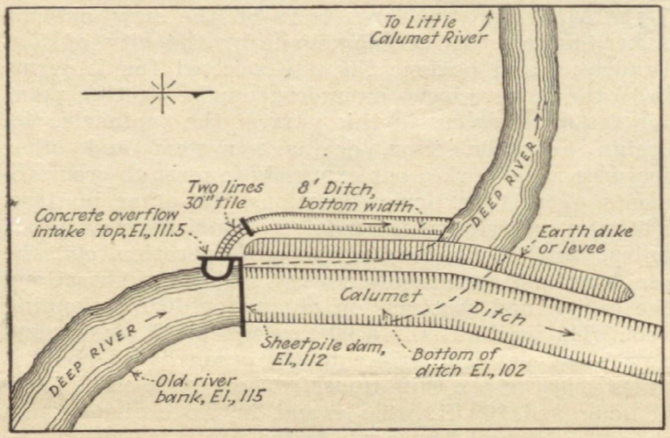

FIG. 2—DIVERSION DAM AND BYPASS

carry the flood waters were made on a basis of the ditches carrying $\frac{1}{4}$ in. in depth from the entire contributing watershed, which is equivalent to 6.6 sec.-ft per square mile. The total area of the watershed is 333 square miles. From a watershed map the areas that would be drained by the Salt Creek arm and the main ditch were obtained and these multiplied by 6.6, to determine the total quantity of water the two channels would carry. For the channel to the lake, these two quantities were added together. In calculating the necessary sizes for the ditches, Chezy's formula was used to determine the velocity and Kutter's formula to determine the constant for erosion. It was found that for the main ditch, from Deep River to the junction, a ditch 7.2 miles long with a base of 50 ft. and side slopes of 1 on 1 would be necessary. The Salt Creek arm will be 1.5 miles long with a base of 40 ft. and slopes of 1 on 1. From the junction to the lake the outlet ditch will be 1.2 miles long with a base of 70 ft. and side slopes of 1 on 2, owing to the sandy soil. These side slopes are found to stand successfully.

Owing to the drop from the Salt Creek arm into the main ditch, it was deemed advisable to put a dike or submerged dam in the former about 900 ft. from the junction. Having a distance of only $1\frac{1}{2}$ miles for a fall of nearly 11 ft., a straight grade could not be used as it would at flood time have a high velocity and cause too much disturbance at the junction of the three channels. The dike will be of timber pile and crib construction, 9 ft. high, 60 ft. long on the crest. To protect the Lake Michigan mouth of the ditch from silting up by the deposit of sediment or the shifting of the beach sand, two jetties 80 ft. apart will extend 225 ft. from the end of the ditch into deep water. These jetties will consist each of a double row of timber piles with rock filling between them.

This project dates back to 1909 and has been delayed by much litigation. The original survey for the channel, known as the Burns or Calumet ditch, was made by Guy Stinchfield as engineer for the drainage district, and at that time county surveyor of Porter County. Remonstrances against the construction of the ditch were filed by some property owners and by the Lake Shore & Michigan Southern Ry. (now part of the New York Central Lines). Adjustments were made in some of the assessments and the railroad's objection was overruled. The plans called for a new channel to be cut through the right-of-way and as the railroad objected to paying for the required bridge, the company appealed the case to the State Supreme Court and then to the United States Supreme Court. All the decisions were against the railroad company, the courts holding that the district could rightly construct its channel across the right-of-way. The company will, therefore, build and pay for the bridge.

After interruption of the project by the World War, further delay was caused by an injunction obtained by the Public Service Co. of Northern Illinois to restrain the drainage district from diverting the dry-weather flow of the Calumet River. This objection was finally disposed of by an agreement between the company and the district by which the dry-weather flow of Deep River will take its present course westward through the Little Calumet River channel, by the arrangement shown in Fig. 2. The river channel will be blocked by a sheetpile dam forming the head of the new drainage ditch, and a bypass will connect the river channel above and below the dam, an earth levee being built between the two channels, as shown. Above the dam will be an overflow intake, with its top at El. 111.5, to deliver the low-water flow to two 30-in. tile drains discharging into an open ditch leading to the river. When flood water in the upper part of the river rises 6 in. above the top of the intake it will begin to flow over the dam, with crest at El. 112, into the new drainage ditch.

All legal obstacles being disposed of, a construction contract was let in August, 1923. Work was com-

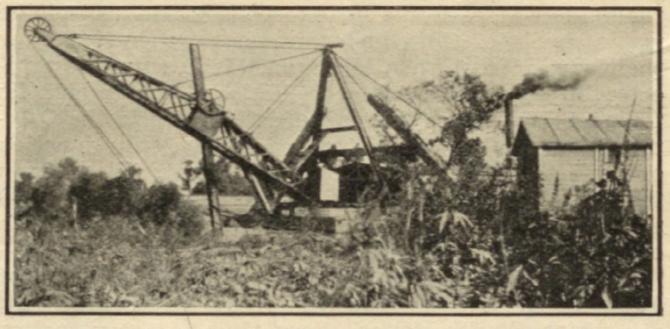

FIG. 3—DREDGE CUTTING DITCH IN SWAMP

menced early in 1924 and is now in active progress. For the 1,657,000 cu.yd. of marsh work the contractor is using a floating dredge equipped with a $2\frac{1}{2}$-yd. bucket. This machine, Fig. 3, works two 12-hour shifts of four men each, except that the day shift has three extra men for supplying coal and clearing right-of-way. Work was begun Sept. 11, 1924, and is averaging 2,000 cu.yd. per day. The cut ranges from 12 to 21 ft. The new channel through the sand hills, consisting of 987,000 cu.yd., was let to a sub-contractor who is using a dragline machine equipped with Diesel engines, for which the fuel oil is hauled by teams in 50-gal. barrels. The bucket is $3\frac{1}{2}$ cu.yd. capacity and the boom is 115 ft. long. This machine, shown in Fig. 4, works three 8-hour shifts of four men each. It began work July 10, 1924, and is averaging 2,500 cu.yd. per day. The cut ranges from 30 to 60 ft., but most of it is about 35 feet.